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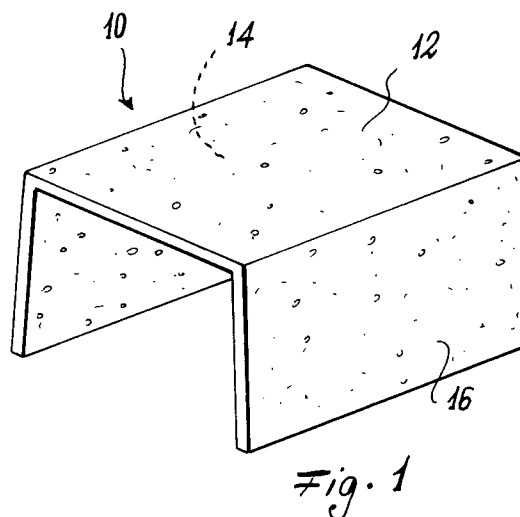
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**I-20129 Milano (IT)**(54) **Lightening element for reinforced concrete floors and staging.**

(57) The lightening element for reinforced concrete floors and staging, of the type comprising lightening elements (10), is channel-shaped and consists of light concrete. The lightening element can comprise a reinforcement.

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This invention relates to a lightening element for floors and staging of reinforced concrete (this material being indicated hereinafter as r.c. in the usual manner).

One example of floors comprising lightening elements is the known floors formed from lattice slabs, consisting of prefabricated rectangular r.c. slabs in which reinforcement lattices formed from steel rods are partially embedded during the slab prefabrication, the lattices being arranged parallel to two sides of the slab at a predetermined distance between axes. When these lattice slabs have been installed side by side, corresponding rows of modular lightening elements, normally polystyrene or tile blocks, are arranged between the lattices of the individual slab. The floor is then completed with a concrete casting of suitable thickness covering the entire assembly. When the concrete has set a monolithic floor is obtained in which said lightening elements remain incorporated. As a substitute for these latter, channel-shaped electric welded meshes clad with a plastics sheet have been proposed, these channels being arranged between two adjacent lattices with their concavity facing downwards, so that when the finishing casting has been laid a sort of lightening tunnel is obtained.

Another type of floor or staging comprising lightening elements of one of the said types is that in which r.c. is cast in situ to form a lower plate and an upper plate spaced apart from each other and connected together by a series of parallel ribs or two series of crossed ribs, the lightening elements remaining trapped between the two plates.

All the aforesaid floors have various drawbacks, including:

- the cost of currently used lightening elements;
- the fact that the polystyrene or tile blocks absorb the water contained in the concrete casting, which water can remain stagnant within the floor for a considerable time, with all the serious deriving problems;
- in the case of in-situ cast double plate floors or staging, the need to make the casting in two stages at least twentyfour hours apart to allow sufficient setting of the lower plate in order to be able to arrange the polystyrene blocks on it means that steel connectors have to be positioned projecting from the first plate to achieve a monolithic floor, with the cost that this involves;
- in the case of polystyrene blocks, the difficulty of maintaining them in position while laying the finishing casting;
- the fact that in the case of fire the polystyrene produces toxic gases even if protected by an r.c. slab or plate, a floor comprising known lightening elements in any event not

offering high fire resistance.

The object of the present invention is to provide a lightening element of the aforesaid type which does not have the stated drawbacks of known lightening elements.

Said object is attained by the modular lightening element of the present invention, characterised by being channel-shaped and consisting of light concrete.

As is known to the expert of the art, light concrete is formed by replacing conventional inerts (gravel) in normal concrete with inerts of very low specific gravity, such as expanded clay or pumice balls or polystyrene beads, or by replacing the inerts with voids to obtain so-called cellular concrete.

The modular lightening element according to the present invention is used by laying it, with its concavity facing downwards, on a lower slab or plate which has just been cast. In this manner its lower edges penetrate slightly into the casting because of the weight of the element, to remain trapped within it when setting has occurred. Consequently in the case of prefabricated lattice slabs, normally comprising two rows of adjacent lightening elements (each row forming a tunnel), the lightening elements according to the present invention remain permanently connected to the slab. Hence this latter already incorporates the lightening elements. Consequently, when the adjacent lattice slabs have been laid, it is necessary merely to apply the finishing casting to obtain the relative floor.

The lightening element according to the present invention is formed from a material which in practice does not absorb water or, even if containing polystyrene beads, absorbs it in minimal quantity such as not to give rise to the problems of known lightening elements. In any event any water stagnation within the floor can be prevented by simply providing suitable holes in the prefabricated lattice slab or in the lower plate in the case of the said double plate floors cast in situ.

The lightening element can comprise a reinforcement, such as a steel mesh, conveniently of electric welded type.

As the lightening element according to the present invention consists of a material of high fire resistance, the floor or staging containing it will also have this characteristic, which is particularly important in view of current antifire regulations.

It should also be noted that although the lightening element of the present invention is of fairly low specific gravity, it has high mechanical strength due to its box form, this being decidedly improved by the possible presence of a reinforcement. In this respect, if properly dimensioned, the lightening element does not suffer from breakage problems ei-

ther during transport or during its installation and the laying of the finishing casting for the floor or staging.

The lightening element can be produced in a range of sizes, so as to satisfy all design requirements for floors or staging of the type comprising lightening elements.

In particular, using said lightening element, floors and staging of crossed rib type can be formed.

Conveniently the lightening element can also comprise an element for closing one and/or the other of the two open ends of the lightening element, when used. In this manner, when a row of lightening elements has been installed, said closure element can be used to close the outwardly facing end of the first and last lightening element of the row, hence preventing the finishing concrete entering the tunnel formed by the lightening element of the row (even though it normally does so only over a short distance). The closure element is conveniently flat and can comprise a reinforcement, preferably of electric welded steel mesh.

The invention will be more apparent from the description of one embodiment thereof given hereinafter by way of example. In this description reference is made to the accompanying drawing, in which:

Figure 1 is an isometric view of the lightening element;

Figure 2 is an isometric view of the closure element to be positioned at the front and rear ends of the row of lightening elements of Figure 1; and

Figure 3 is a cross-section (limited for simplicity to a width equal to the width of one prefabricated lattice slab) of a portion of a lattice slab floor, taken on a plane perpendicular to the load-bearing direction of the floor.

As can be seen from Figure 1, the lightening element 10 is channel-shaped (in the figure it being shown inverted, in its position of use). The element 10 consists of a horizontal wall 12 and two lateral walls 14 and 16 extending downwards and slightly diverging. The thickness of the lateral walls 14 and 16 and of the base wall 12 is chosen on the basis of the dimensions of the element itself and of the type of concrete with which it is formed, such as to achieve sufficient strength for its purpose.

As stated, particularly in the case of larger-sized lightening elements these can include a reinforcement (not shown on the drawing for reasons of simplicity and clarity). As is apparent to the expert of the art, a particularly convenient type of reinforcement is electric welded steel mesh.

The closure element 18 shown in Figure 2 is flat and is of isosceles trapezium shape, suitable for closing the two open ends of the tunnel formed

by a row of lightening elements 10, to prevent the floor finishing casting entering said tunnel. As stated, the closure element 18 can also be provided with reinforcement (for simplicity not shown on the drawing), for example of electric welded steel mesh.

From Figure 3 it can be seen that the floor portion 20, of lattice slab type, consists of a prefabricated lattice slab 22 comprising an r.c. slab 24 in which three usual reinforcement lattices 26, 28, 30 are partially embedded. During the prefabrication of the lattice slab 22, having made the relative concrete casting - in which the longitudinal reinforcements (the lower longitudinal rods of the lattices 26, 28, 30) and the transverse distribution reinforcements 34 remain incorporated - the lightening elements are rested directly on said casting in two rows (indicated respectively by 10A and 10B in Figure 3), each row of lightening elements being contained centered between two adjacent lattices.

As stated, the lower edge of the lateral walls of the lightening elements 10A and 10B sink slightly into the casting because of their weight. Consequently when the slab 24 has set, the lightening elements 10A and 10B remain fixed permanently in the slab 24 to form a single body with the lattice slab 22.

As is apparent to the expert of the art, once the lattice slab 22 has been installed it is necessary merely to lay a finishing casting 32 of normal concrete to obtain the floor portion 20 of Figure 3.

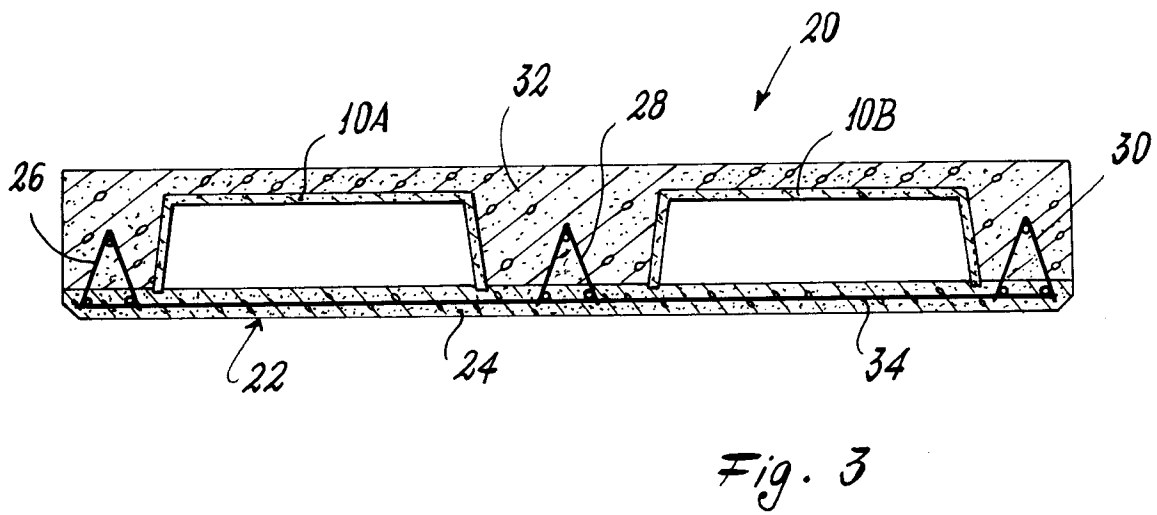
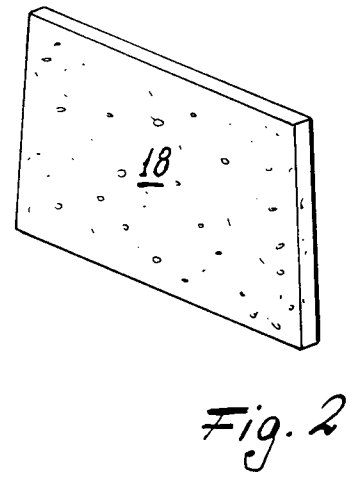
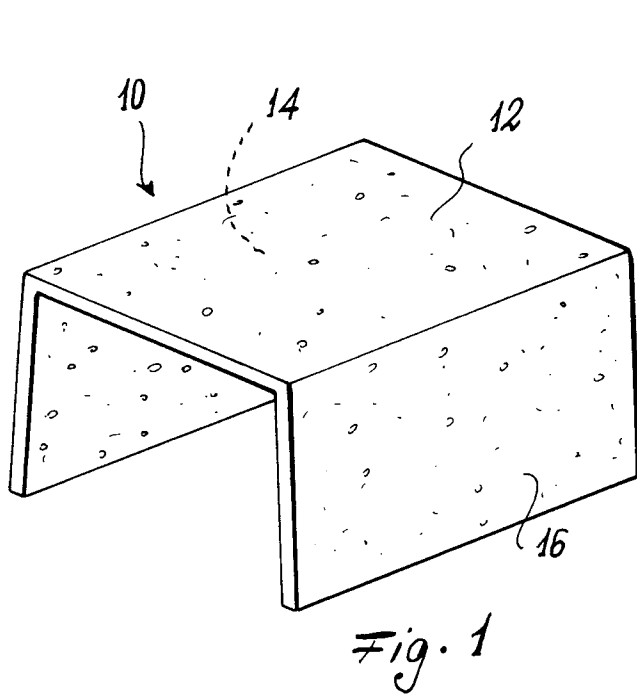
It will be apparent that the use of the lightening element according to the present invention is not limited to the type of floor (of lattice slabs) shown in Figure 3. In this respect it has already been stated that the lightening element can also be used for example in r.c. floors completely cast in situ and consisting of two plates (an upper and a lower) connected by ribs delimited by the lateral walls of the lightening elements.

It should be noted that the use of the lightening element according to the present invention does not substantially modify any of the conventional operating stages involved in the production of slab floors, or the stages involved in forming floors and staging cast in situ using lightening elements.

### Claims

1. A modular lightening element for reinforced concrete floors and staging, characterised by being channel-shaped and consisting of light concrete, possibly reinforced.
2. A lightening element as claimed in claim 1, characterised in that its lateral walls slightly diverge.

3. A lightening element as claimed in claim 1 or 2,  
characterised by comprising a reinforcement.
4. A lightening element as claimed in claim 1 or 2,  
characterised by also comprising a closure  
element for closing one and/or the other of the  
two open ends of the lightening element, when  
used. 5  
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5. A lightening element as claimed in claim 4,  
characterised in that the closure element com-  
prises a reinforcement. 15  
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## EUROPEAN SEARCH REPORT

Application Number  
EP 94 11 8406

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                     |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                       |                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Category                                                                                                                                                                                                                | Citation of document with indication, where appropriate, of relevant passages                                                                                                              | Relevant to claim                                                                                                                                                                                                                                                                     | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
| X                                                                                                                                                                                                                       | FR-A-1 275 848 (KNAPP)                                                                                                                                                                     | 1-3                                                                                                                                                                                                                                                                                   | E04B5/19                                     |
| Y                                                                                                                                                                                                                       | * page 1, column 1, paragraph 2 *<br>* page 2, column 1, paragraph 3 *<br>* page 2, column 1, paragraph 5 *<br>* figures 1-6 *<br>résumé 1,2a,2c<br>---                                    | 4,5                                                                                                                                                                                                                                                                                   | E04B5/36                                     |
| Y                                                                                                                                                                                                                       | DE-A-15 34 696 (ATLAS STONE COMPANY)<br>* page 2, paragraph 5 *<br>* figures 1,4 *<br>---                                                                                                  | 4,5                                                                                                                                                                                                                                                                                   |                                              |
| A                                                                                                                                                                                                                       | GB-A-2 070 097 (SOFTWARE LICENCEES LTD)<br>* page 1, line 16 - page 1, line 20 *<br>* page 2, line 2 - page 2, line 5 *<br>* page 2, line 33 - page 2, line 38 *<br>* figures 1,2 *<br>--- | 1,3                                                                                                                                                                                                                                                                                   |                                              |
| A                                                                                                                                                                                                                       | CH-A-565 909 (KATZENBERGER)<br>* column 1, line 56 - column 1, line 59 *<br>* figures 1-7 *<br>---                                                                                         | 1                                                                                                                                                                                                                                                                                     |                                              |
| A                                                                                                                                                                                                                       | CH-A-167 077 (NETSCHER)<br>-----                                                                                                                                                           |                                                                                                                                                                                                                                                                                       |                                              |
| The present search report has been drawn up for all claims                                                                                                                                                              |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                       |                                              |
| Place of search<br>THE HAGUE                                                                                                                                                                                            |                                                                                                                                                                                            | Date of completion of the search<br>27 March 1995                                                                                                                                                                                                                                     | Examiner<br>Hendrickx, X                     |
| <b>CATEGORY OF CITED DOCUMENTS</b>                                                                                                                                                                                      |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                       |                                              |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                                                                            | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>-----<br>& : member of the same patent family, corresponding document |                                              |